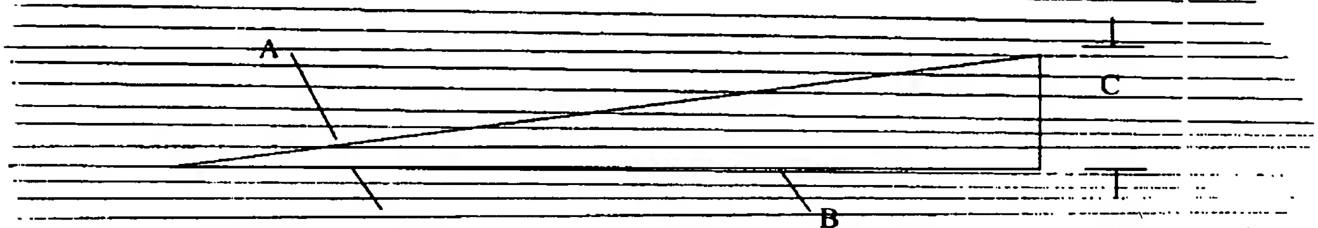
SPECIFICATION AMENDMENTS -

Paragraph starting on page 6, line 17 and ending on page 7, line 7 of the original disclosure:

As described herein, properly manufactured, and installed within the hull of a marine vessel, the present invention marine reaction thruster is designed to propel fluid by discharging it rearward with a reaction of increased force. This is accomplished by using a succession of increasingly smaller propellers mounted on the same drive shaft within a conical/tapered housing and ensuring that each propeller has a maximum the pitch angle of approximately 10° to 12°. ~~Pitch angle is defined by the following diagram.~~



~~A= 10°-12° pitch angle~~
~~B= propeller circumference~~
~~C= propeller pitch – theoretical distance the propeller would advance~~ in one revolution
Pitch angle is defined by the diagram in Fig. 16.

Paragraph starting on page 7, line 9 and ending on page 10, line 4 of the original disclosure:

The constant volume of fluid moving across the successively smaller propellers, in combination with the decreasing cross-sectional dimension of the propeller housing, sequentially increases the velocity of the seawater moving through the housing as it passes each propeller. An example of how the present invention causes increased operating efficiency over conventional

marine propulsion systems is identified below. If the first propeller of the present invention propeller would be made with a diameter dimension of approximately ten inches and a pitch of approximately five-and-one-half inches, it would move approximately one-hundred-seventy-one cubic inches of fluid in one revolution. The next smaller propeller mounted on the same drive shaft would then be approximately nine-and-one-fourth inches in diameter and have a pitch of approximately six-inches. Since the volume of the fluid passing the second propeller is the same as that moving past the first propeller, the velocity of the fluid has now accelerated approximately 1%, generating a thrust reaction for the fluid as it approaches the third propeller. Then, if the third propeller is made with a diameter dimension of approximately eight inches and a pitch of approximately six-inches, and if its overall pitch angle is maintained at approximately 11°30', the third propeller will further increase the velocity of the seawater moving rearwardly within the conical/tapered housing. When a fourth propeller is made with a diameter dimension of approximately seven-and-one-half inches and a pitch of approximately six-and-one-half inches, and its is mounted on the same drive shaft behind the other three propellers, and further where the discharge opening of the conical/tapered housing is approximately three inches in diameter (or approximately 9.42 square inches), the velocity of the one-hundred-seventy-one cubic inches of seawater as it exits the discharge opening is increased by approximately 20%. Further, as a result of the design of a keyhole-shaped opening in a cover plate mounted flush with the associated marine hull and aligned with the inlet opening of the present invention's conical/tapered housing, a large volume of seawater is drawn up into the conical/tapered housing without cavitation when the hull moves in a forwardly direction. The narrow end of the keyhole shape must face the bow of the associated marine hull, whereby the laminar flow of seawater

across the forwardly moving hull is caused to form eddys at the outside edges on the narrow end of the keyhole-shaped opening and seawater to thereafter flow into the conical/tapered housing at the center of its leading edges, making a right angle or knee turn (genuflect) into the keyhole-shaped inlet opening. Rounded edges on the narrow end of the keyhole-shaped opening will cause the eddys to form, and prevent the seawater from bypassing the opening. However, the efficiency of seawater inflow is increased by use of inwardly sloping edges adjacent to the narrow portion of the keyhole-shaped inlet opening. The larger and wider rear portion of the keyhole-shaped opening can also be angled or otherwise made sloping on its rear top surface to enhance upward seawater flow into the conical/tapered housing and maximize efficiency. Thus the eddys which are formed in the narrow end of the keyhole-shaped inlet opening redirect the inertial energy of the laminar flow to move upward (genuflect) into the conical/tapered housing of the present invention and thereby induce the main flow of seawater to follow without protest. Due to the large amount of seawater induced to flow into the keyhole-shaped inlet opening, which prevents steam bubbles that are low in temperature and pressure from forming, cavitation is eliminated as the seawater moves toward the first propeller. Also, the present invention is easily maintained. The need to clean drag-producing debris from the present invention propeller blades, or the strut that supports the distal end of the drive shaft upon which the propellers are mounted, is reduced when a debris-cutting blade is positioned for rotation in front of one or more of the propellers, and optionally in front of the strut. The debris cutter in front of the strut may be larger that those positioned in front of the propellers. Since it is contemplated for the motor connected to the drive shaft to always have a ~~left~~ right-hand rotation, all components affected by drive shaft rotation will also have a ~~left~~ right-hand configuration, including the positioning of the

cutting edges on each debris cutter used. Also, the front casting, inlet opening cover plate, and strut plate are removable for easy maintenance access to the strut, drive shaft, and propellers. In addition, failure of the present invention propellers is reduced since they are internally located within a protective conical/tapered housing that is further protected by a marine hull. Thus, unless there is a hull breach, the propellers are unavailable for direct contact with large marine life or underwater objects such as reefs and sand bars. Further, the fact that no transmission is required allows for a simple construction, and the present invention has a nearly silent operation that could benefit submarine vessels used in research and military applications. However, since no transmission is present, a change in the direction of movement for the marine hull associated with the present invention is preferably accomplished by a reverse and steering assembly positioned rearward from the discharge opening, which includes opposing rudders having Ackerman geometry that allows one rudder to move more that the other while the associated marine hull is making a turn and the second rudder to move more than the first while making a turn in the opposite direction, for less disruption of the water and enhanced operating efficiency. Rearward movement of the associated marine hull is also simply accomplished by use of a movable gate within the reverse and steering assembly that deflects the seawater flowing rearwardly from the conical/tapered housing into a downward and forwardly direction under the hull. Sturdy, non-corrosive materials, and oversized fasteners, further make the present invention durable for long-term use.

Paragraph starting on page 10, line 5 and ending on page 10, line 20 of the original disclosure:

While the description herein provides preferred embodiments of the present invention, it

should not be used to limit its scope. For example, variations of the present invention, while not shown and described herein, can also be considered within the scope of the present invention, such as variations in the number of propeller blades used within the conical housing; the materials used for manufacture of the conical/tapered housing; the number, size, configuration, type, and positioning of bolts and/or other fasteners used to attach components of the present invention together and the conical/tapered housing in its usable position against the inside surfaces of the marine hull bottom and its transom; the length and width dimensions of the keyhole-shaped opening used to induce a large volume of seawater (genuflect) through the bottom surface of the associated marine hull as long as such dimensions remain in substantial proportion to the keyhole-shaped configuration shown and described herein; the safety precaution means used to prevent large objects from entering the keyhole-shaped opening in the marine hull in very large embodiments of the present invention, and the number of present invention thrusters that can be used in association with larger marine hulls, such as a submarine. Thus, the scope of the present invention should be determined by the appended claims and their legal equivalents, rather than being limited to the examples given.

Paragraph starting on page 12, line 15 and ending on page 12, line 20 of the original disclosure:

Fig. 6 is a side view of one preferred embodiment of debris cutter contemplated for use with the propellers and/or strut in the most preferred embodiment of the present invention marine reaction thruster with its cutting edges configured for ~~left~~ right-hand rotation and a curved arrow showing the direction of its rotation, and with the cutter also having a means for a keyed attachment to the drive shaft upon which the propellers are mounted for movement in unison with the drive shaft and propellers.

New paragraph to be inserted on page 14, line 18 of the original disclosure:

Fig. 16 is diagram defining the maximum pitch angle for each of the increasingly smaller propellers of the present invention that are mounted on the same drive shaft within a conical/tapered housing.

Paragraph starting on page 14, line 20 and ending on page 17, line 21 of the original disclosure:

The present invention is a propulsion system designed to move a marine vessel (represented only by hull 24 and transom 36) by discharging seawater rearwardly with a reaction of increased force that is approximately twenty percent greater than conventional propeller systems of comparable size (not shown). Mounting of the wider end of the conical/tapered housing 8 of the present invention, its suction side, is contemplated against the inside of bottom surface 24 of an associated marine hull, with the narrow discharge end of conical/tapered housing 8 being attached to the inside surface of the transom 36. Below its wider end, conical/tapered housing 8 has an inlet opening 10. An inlet opening cover plate 28 with a central keyhole-shaped opening 32 is connected to the outside of bottom surface 24, in a position aligned with inlet opening 10 and flush with the outside of bottom surface 24, whereby the keyhole-shaped opening 32 is designed to the inflow of a large volume of seawater into the wider end of conical/tapered housing 8 without cavitation when the marine vessel moves in a forwardly direction, with the seawater (shown via arrows in Fig. 7) thereafter being directed across a succession of increasingly smaller turbine/propeller blades 4A-4D attached to a common shaft 6, then exiting the narrow end of housing 8 through discharge opening 14. To prevent cavitation and avoid stalling of its propeller blades 4A-4D, each propeller 4A-4D is installed with a maximum pitch angle of approximately ten to twelve degrees, <u>being defined in terms of the propeller's circumference and the theoretical distance the propeller would advance in one revolution (as shown in Fig. 16)</u>. As a result, since the volume of fluid passing by each successively smaller propeller blade 4B, 4C, or 4D is constant and each next smaller propeller 4B, 4C, or 4D must

move more cubic inches of seawater per revolution than its adjacent larger propeller 4A, 4B, or 4C, the velocity of the seawater through conical/tapered housing 8 is increased and a thrust reaction is generated. An upwardly directed strut 12 positioned between the smallest propeller blade 4D and discharge opening 14 secures the distal end of shaft 6 centrally within conical/tapered housing 8. To control the direction of movement of the associated marine vessel, in the most preferred embodiment 2 of the present invention a reverse and steering assembly 34 with a movable gate 48 is attached to outside surface of transom 36 and aligned with discharge opening 14. When gate 48 is fully opened, the marine vessel moves in a forwardly direction. However, as gate 48 is lowered, rearward discharge of the seawater behind reverse and steering assembly 34 is at least partially blocked, instead forcing all or a portion of the discharged seawater into a downward and forwardly direction under the marine vessel, which causes forward motion of the vessel to cease, or reverse vessel movement to occur. While the crescent-shaped rudders 42 positioned within reverse and steering assembly 34 have Ackerman geometry to cause less disruption of water for enhanced efficiency during turns, with one rudder moving more than the other for a turn in one direction and vice versa for a turn in the opposing direction, the velocity of marine vessel movement is regulated by the speed of an inboard engine connected via drive shaft 6 to propellers 4A-4D. Steering via rudders 42 can take place while the marine vessel is moving forward or in reverse. Further, since each propeller blade 4A-4D positioned for rotation within conical/tapered housing 8 substantially fills the cross-sectional dimension of housing 8, propeller blade 4A in the wider end of conical/tapered housing 8 necessarily has the largest diameter dimension and propeller blade 4D, which is closest to transom 36, would have the smallest diameter dimension. Strut 12 secures the distal end of drive shaft 6 centrally within conical/tapered housing 8. Also, the reduced maximum pitch angle of each propeller blade 4A-4D to between ten and twelve degrees increases present invention efficiency by creating a reduction in outgassing and cavitation of the seawater moving through conical/tapered housing 8. Further, a debris-cutting member 16 is preferably employed in front of each propeller blade 4,

and optionally in front of strut 12, to cut up pieces of seaweed, rope, and/or other debris in the seawater entering conical/tapered housing 8 and thereby prevent propeller-slowing clogs and elongated objects (not shown) from becoming wrapped around propellers 4A-4D or strut 12 and impeding seawater flow through housing 8. The debris-cutting members 16 associated with each propeller, 4A-4D and strut 12 can have the same or different configuration and dimension from the other debris-cutting members 16, however, each debris-cutting member 16 should not be so large relative to the propeller 4 immediately behind it as to block efficient flow of seawater across that propeller 4. Fig. 1 shows the debris-cutting member 16 in front of strut 12 being larger that the debris-cutting members 16 in front of propellers 4A-4D. However, this is not critical. Further, size is not a limiting factor for the present invention and it can be enlarged or reduced in dimension during manufacture to provide optimum propulsion benefit for nearly any size of marine vessel targeted for use therewith. However, when the size of the keyhole-shaped opening 32 through inlet opening plate 28 increases sufficiently to place humans and large marine life (not shown) at risk for being sucked into conical/tapered housing 8 during present invention operation, it is contemplated for a grate (not shown) and/or other appropriately configured means to be secured across inlet opening 32 so as to prevent large objects from entering housing 8 while at the same time continuing to allow a large volume of seawater to enter the suction side of housing 8 without cavitation. Further, since the present invention propulsion system is enclosed within housing 8, which is positioned within a marine hull 24 and discharges fluid efficiently through a rear discharge opening 14 without the need for a transmission, its operation is virtually silent. In addition, the internal positioning of propellers 4A-4D reduces the possibility of them being damaged by contact with reefs, sandbars, and other underwater obstacles (not shown). Further, since no transmission is required, manufacturing cost is reduced. Recreational, commercial, and military applications are contemplated for both submarine and surface vessels.

Paragraph starting on page 27, line 21 and ending on page 28, line 21 of the original disclosure:

Fig. 6 shows a preferred embodiment of debris cutting member 16 used in the present invention marine reaction thruster in association with each propeller 4A-4D, and optionally in front of strut 12. Debris cutting members 16 each have a central opening 54 configured for insertion therethrough of drive shaft 6 and a rectangular-shaped cutout 52 configured to mate with key 18 on drive shaft 6. The rectangular shapes of key 18 and cutout 52 are not critical, as long as their configurations cause debris cutting member 16 to rotate in unison with drive shaft 6. It is contemplated for the cutting edges 50 of debris cutter 6 to be very sharp so that debris in seawater drawn through inlet opening 10 is sufficiently shredded to avoid becoming wrapped around the propeller 4 or strut 12 behind it and creating drag. Also, since in the most preferred embodiment 2 of the present invention the motor (not shown) connected to drive shaft 6 would always have a ~~right~~ left-hand rotation, an arrow in Fig. 6 shows the contemplated direction of rotation for all debris cutting members 16, and the uniform positioning of all sharp edges 50 on debris cutting members 16 in the direction of rotation. The materials from which debris cutting members 16 are made should be strong and corrosion-resistant, and a material that can hold a sharp edge so as to reduce maintenance. While the number of debris cutters used is not critical, periodic maintenance resulting from the need to clean drag-producing debris (not shown) from propellers 4A-4D is reduced by use of a debris cutting member 16 positioned for rotation in front of each successive propeller 4 and strut 12. It is considered to be within the scope of the present invention for the diameter dimension and configuration of cutting edges 50 of debris cutting members 16 to be selected according to the size of the propeller 4 or strut 12 with which it is being used. Fig. 7 shows the debris cutting member 16 positioned in front of strut 12 to be larger

than the debris cutting members 16 positioned in front of propellers 4A-4D, however the sizes shown are not critical. Further, the thickness dimension of the debris cutting members used is not critical, and can vary according to the need.

New paragraph to be added on page 32, line 5 of the original disclosure:

Fig. 16 shows diagram defining the maximum pitch angle for each of the increasingly smaller propellers 4A-4D of the present invention that are mounted on drive shaft 6 within conical/tapered housing 8, with reference to the circumference of each propeller 4A-4D and the theoretical distance it would travel in one revolution.